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(54) Infra-red radiation device

(57) The present invention relates to an infra-red (IR) radiation device comprising a shell or reflector body with body-holders (3) mounted on the ends thereof and also holders (6) for accommodating IR lamps. Each shell or body includes a plurality of individual reflector parts comprising reflector plates preferably of parabolic shape. The body-holder (3) comprises a web and a recumbent U-shaped element located at the end of the body adjacent the open reflector side. The free leg of the U-shaped element includes a glass holder in which a glass plate (4) can be inserted to insulate IR lamps (5) from dust and dirt. The U-shaped element is provided with holes for screws (8). The holder or reflector and/or the body-holder (3) includes or include air gaps or holes intended for cooling air which preferably cools the ends of the lamps.

Fig. 7

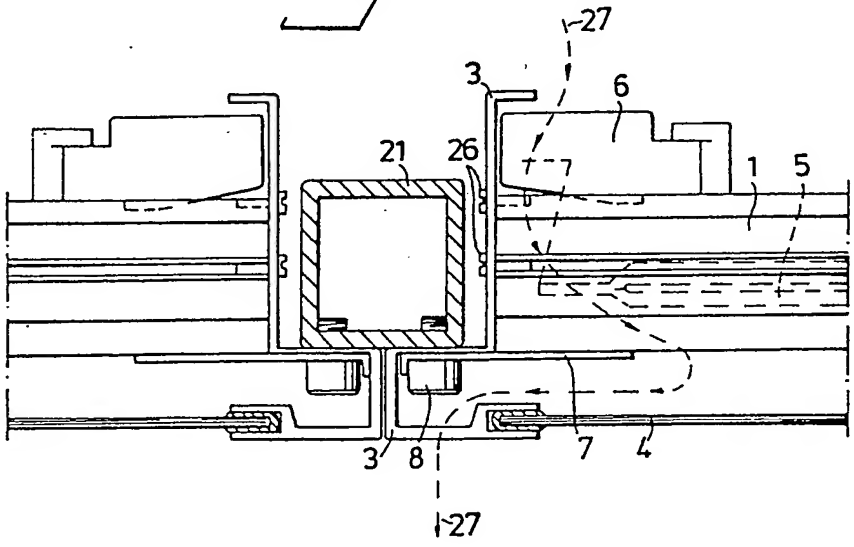

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Fig. 1

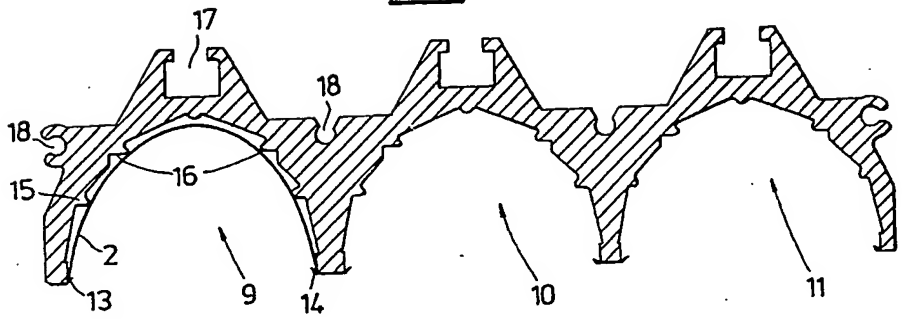

Fig. 2

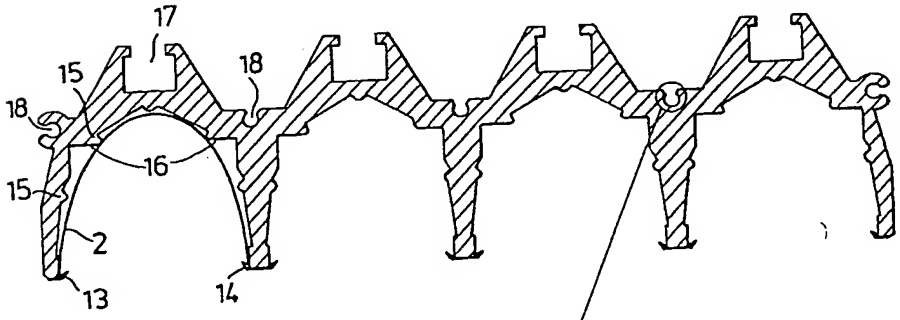

Fig. 3

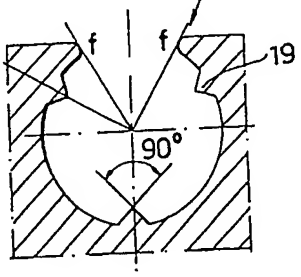

Fig. 4

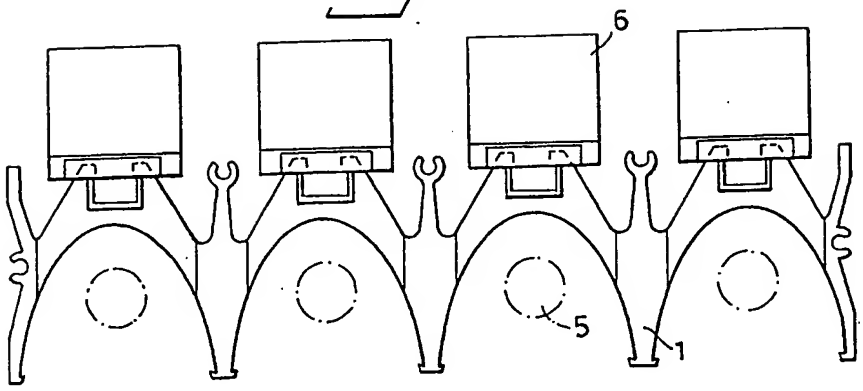

Fig. 5

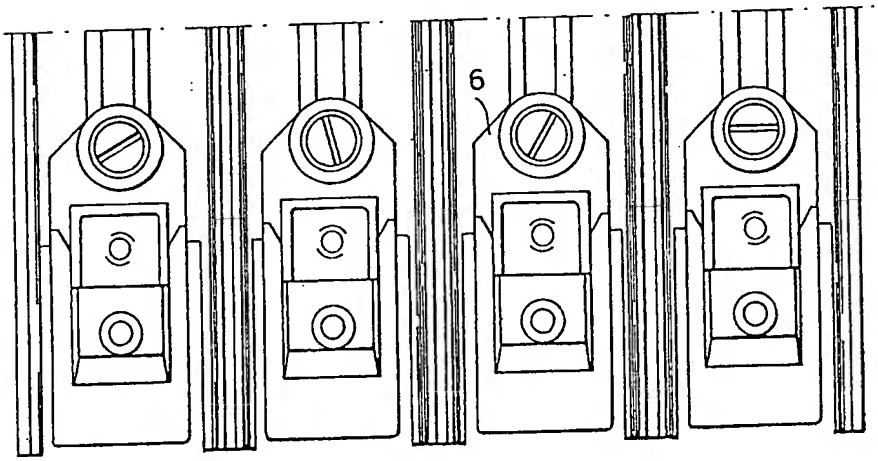

Fig. 6

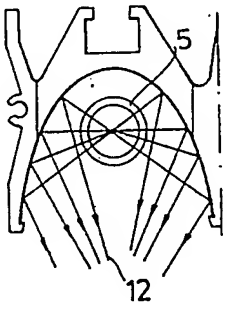

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Fig. 7

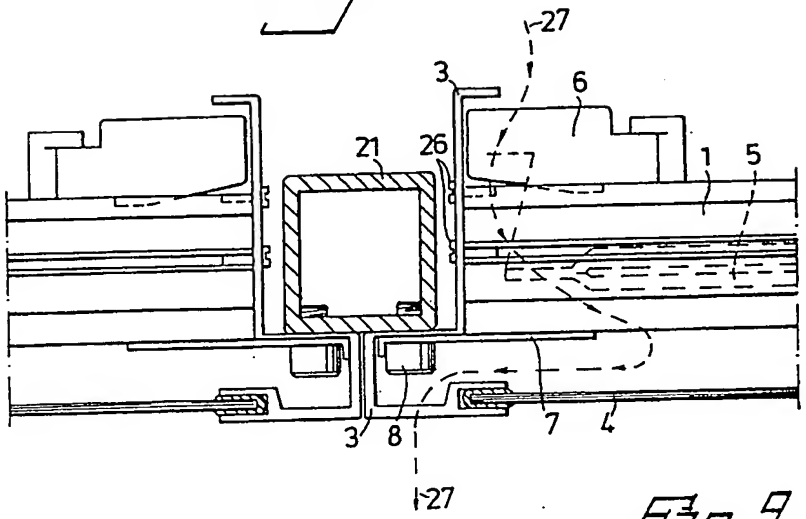


Fig. 8

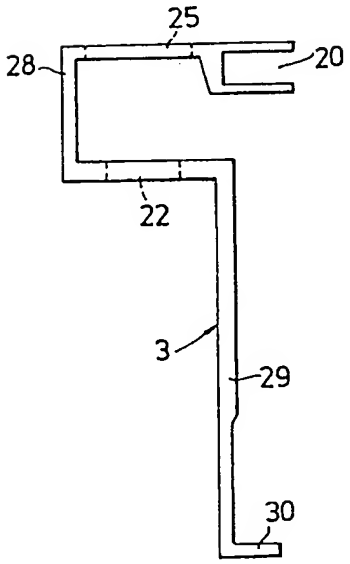


Fig. 9

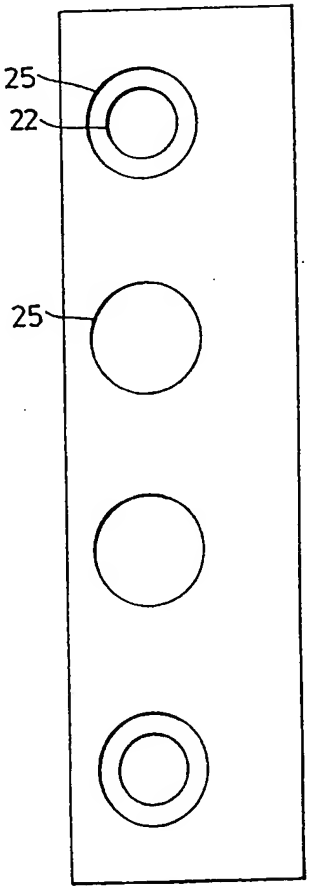
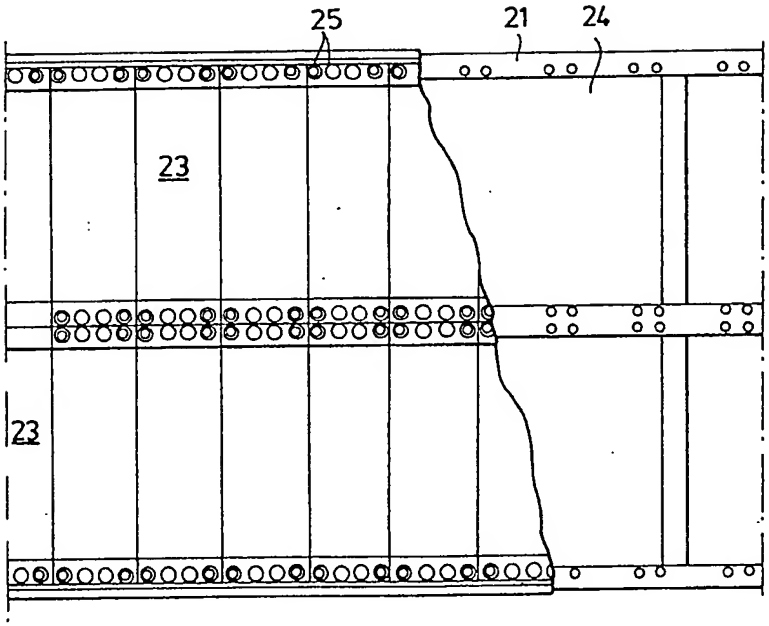


Fig. 10



SPECIFICATION

Infra-red radiation device

The present invention relates to an infra-red (IR) radiation device comprising a shell or reflector body having sets of body-holders and lamp holders.

Such radiation devices are used in widely different fields for different purposes. The radiation device according to the present invention is intended particularly, although not exclusively, for drying and/or treating paper and other web-forming materials from which, for example, water is to be removed by evaporation. In this respect, high drying powers per unit of surface area are required if the treatment device is not to become excessively bulky and expensive. In addition, there is required a high energy efficiency, a high degree of reliability, and the possibility of servicing and maintaining the device in a ready and simple fashion. These requirements are caused by the desire to effect production, for example on a paper machine, practically continuously and without interruption throughout the whole year. The most serious factors liable to cause disturbances in this respect are the particularly large amounts of dirt and dust generated and high air humidities.

Consequently, the object of the present invention, particularly with a view to the above-mentioned difficulties, is to provide an infra-red radiation device which will counteract these problems to the greatest possible extent.

This object is achieved in accordance with the invention by designing an infra-red radiation device of the kind abovementioned in which the shell or reflector body and/or the body-holders is, or are, provided with air gaps, holes or the like and/lor provided with other means for conducting cooling air and for insulating against the surroundings and/or for thermal insulation.

The invention will now be described with reference to the accompanying drawings in which:

Figure 1 is an end view of the body or shell of an infra-red device according to the invention.

Figure 2 is an end view of a second embodiment of the body or shell of the device.

Figure 3 is an enlarged view of the ringed part of the device illustrated in Fig. 2.

Figure 4 is an end view of a third embodiment of the body or shell of the device, having lampholders thereon, and illustrates sources of infra-red radiation.

Figure 5 is a plan view of the device illustrated in Fig. 4.

Figure 6 illustrates the pattern of radiation obtained from an individual infra-red radiator of the device shown in Fig. 4.

Figure 7 is a longitudinal sectional view of mutually adjacent infra-red radiation devices provided with holder means.

Figure 8 is a side view of a body-holder for an infra-red radiation device.

Figure 9 is a top plan view of the body-holder shown in Fig. 8, and

Figure 10 is a bottom plan view of an array of infra-red radiation modules according to the invention.

In the drawings identical or equivalent elements are identified by the same reference numerals.

A shell or reflector body 1, see Fig. 1, comprising a set of, for example two to five, individual reflectors 9, 10, 11. Each reflector see Fig. 6, is intended to direct radiation 12 from an IR lamp 5 and to support a reflector plate or the like 2 and other elements. Consequently, an intrinsically rigid multiple arrangement of reflectors 1 guarantees that each IR lamp 5 of the arrangement does not irradiate mutually adjacent lamps and thereby reduce their useful life.

The reflector plates or the like 2 are mounted between projections 13, 14 which extend towards one another from the free edges of each of the reflector bodies. In this way, the flexible plate 2 is curved into a parabolic shape, although without abutting the inside of the associated reflector body. This is effected by means of spacers 15, arranged at various locations, upon which the reflector plates 2 can rest; it is not necessary for the plates 2 to lie against all of the spacers 15 on a reflector body 1. Apart from this, the inside of each of the reflector bodies is of an irregular form, i.e. it follows solely the conditional shape of the inserted plate, whereby there is formed in conjunction with the spacers continuous air gaps, which afford valuable heat insulation. This insulation reduces the otherwise high thermal load on the reflector body 1. In certain instances the spaces between the reflector plate 2 and the reflector body 1 may be filled with a heat insulting material. It will be understood that the profile shape of the reflector body 1 conforms substantially to the whole contour of the inserted plates.

The inside of the respective reflector bodies 1 is also characterised by planar surfaces or ledges 16 located on mutually identical levels and lying opposite one another at the transition region or juncture between the web and the legs of the reflector bodies 1. As a result of these planar surfaces 16, holder means, not shown, can be mounted thereon when manufacturing the reflector bodies 1. This enables the web portions to be punched out or recessed at the ends thereof with the aid of a mechanical punch. This recessing is necessary in order to mount the holder means. The shell or reflector body 1 according to the invention is most suitably extruded from aluminium or aluminium alloy stock. This method of fabrication does not allow the required

recess at the ends of the reflector to be preformed. Consequently it has been necessary hitherto to mill out the desired recesses, resulting in longer fabrication times and higher manufacturing costs. Arranged on the side of the web remote from the inside of the reflector body 1 is a continuous, substantially C-shaped groove 17 which is open away fro the reflector body and in which a lamp holder 6, see Fig. 7, or some other element can be secured, preferably with the aid of a screw, nut or like fastener.

In a preferred embodiment of the invention, see Fig. 2, there is arranged in the web or bottom transition region between the individual reflector bodies, preferably at each location, a longitudinally extending body mounting groove 18. As will be seen from the enlarged view in Fig. 3, the groove 18 is enclosed by a substantialy ring-shaped wall describing an angle greater than 180 degrees in the peripheral direction. At equal angular distances along the periphery there are located shoulders or like promontories 19 in which a thread can be cut, for instance by self-tapping screws, to form a positive anchorage. Such self-tapping screws, or the like, 26 serve to mount a body-holder 3 in the manner illustrated in more detail in Figs. 7 to 9.

As will be seen from these figures, the body-holder 3 extends over the whole width of a multiple reflector body and is provided in the transverse direction thereof with a lower continuous U-shaped element 28, one leg of which extends into a U-shaped glass holder 20, while the other leg of the element merges with an upwardly extending web terminated at its other end with a short, angular gripping flange 30. The glass holder 20, see Fig. 7, serves to support the end of a glass plate 4, whereby the open side of the reflector body 1 is shielded a gainst the ingress of dirt and protected against the risk of fire. This risk can be created by the ingress of combustible substances. The glass holders 20 enable the glass plates 4 to be inserted at right angles to the longitudinal direction of the reflector bodies.

The body-holder 3, see Fig. 7, is mounted on transverse rails or bars 21 with the aid of the outwardly projecting U-shaped element 28, more specifically with the aid of a row of holes 22, 25 formed in the two legs of the element 28, through which screws 8 can be inserted from the side facing the glass plate 4. The screws 8 carry firstly a shield firmly on the inside of the leg of the U-shaped element 28 merging with the web 29 at the same time as the screw-threaded portion of the screw 8 enters a correspondingly tapped hole in the bar 21. The fact that the U-shaped element 28 projects outwardly in relation to the web 29 enables a plurality of reflector bodies to be mounted in mutually abutting relationship, end to end, on a common bar 21. The mounting holes 25 adjacent the glass holder 20 are preferably formed with a larger diameter than the head of the screws 8. This enables the heads of the screws 8 to pass easily through the holes 25.

The reflector bodies, see Fig. 10, are arranged in the form of modules 23, for example beneath a hood 24, in order to cool the reflector bodies and the ends of the lamps. In the majority of cases the temperature at the ends of the lamps should not exceed 300 degrees Celcius. As a result of the construction according to the invention air is conducted, particularly along a flow path shown by the dashed line 27 in Fig. 7, i.e. intensively past the ends of the lamps 5. The lamp-end shields 7 of the respective lamps 5 assist in defining the air flow path 27.

Finally, the air flows through the holes 25 in a direction conditioned thereby. The air is heated as it flows along the flow path 27 to about 50 degrees Celcius and improves the drying process as a result of its directional effect. Air is also conducted thereby across the protective glass 4.

In a typical case, the temperature of the protective glass 4 will lie between 300 and 400 degrees Celcius as a result of the absorbed infra-red radiation from the lamps 5. This temperature has an intrinsic cleansing effect, since the most common binders used in the coating of papers are organic substances, for example cellulose filaments, latex and starch. These substances carbonize at temperatures above about 225 degrees Celcius.

The IR lamps 5 mounted in the lamp holders 6 can be readily replaced by removing the screws 8, leaving a diameter of about 10 mm, whereupon the glass 4 can be displaced to one side and the lamp-end shield 7 lifted. This will release the lamp 5 from the holder 6.

In addition to conducting cooling air past the ends of the lamps, the lamp-end shields 7 also serve to prevent reflected radiation from irradiating the ends of the lamps and thereby heating them. Such heating of the lamp-ends would otherwise shorted the useful life of the lamp.

The reflector plates or the like 2 comprise a highly reflective material capable of withstanding high thermal loads over long periods of time. Suitable materials in this respect are gold and ceramic materials. The plates 2 can readily be withdrawn from the reflector body, for example, when replacing them. As will be understood, inward pressure from the free side of the reflector body is also possible.

The aforedescribed embodiments illustrated in the drawings are only to be considered non-restricting embodiments which can be modified and developed within the scope of the concept of the invention.

CLAIMS

1. An infra-red radiation device comprising a shell or reflector body having mounted thereon body-holders and holders for accommodating IR lamps, characterised in that the shell or reflector body and/or the body-holders is, or are, provided with air gaps, holes or the like and/or provided with other means for conducting cooling air and for insulating against the surroundings and/or for thermal insulation.

2. The device as claimed in claim 1, characterised in that each reflector body comprises a plurality of separate reflectors, particularly two to five reflectors, the web or bottom portions of which lie substantially in line with one another and which in every case include a common leg in the transition region or juncture between two adjacent reflectors.

3. The device as claimed in claims 1 or 2, characterised in that each reflector is arranged to accommodate a reflector plate or like element which is mounted at its free edges in the peripheral direction between two projections extending towards one another from the free ends of respective reflectors.

4. The device as claimed in any of the claims 1 to 3, characterised in that the reflector plates or like elements are flexible and are curved to a parabolic or partial eliptical shape, although without being in abuttment with the inside of the respective reflectors, to which end spacers are arranged at various locations and/or the inside of each reflector is irregular in shape, to provide continuous air gaps in the longitudinal direction of the reflector.

5. The device as claimed in claim 4, characterised in that the inside of each reflector body presents planar surfaces, said surfaces being located on mutually the same level and lying opposite one another in the transition region or juncture between web and leg of the reflector body and being arranged to take a punching or stamping tool.

6. The device as claimed in any of the preceding claims, characterised in that there is arranged, particularly in the transition region or juncture between the webs or the bottoms of the respective reflector bodies and between web and leg respectively of each reflector, a longitudinally extending continuous mounting groove for the body, the grooves being embraced by an approximately circular wall describing in the peripheral direction an angle greater than 180 degrees, there being arranged at equal angular distances apart a plurality of shoulders or like promontories, in which the screw-threads of, for example, self tapping screws can cut a screw-thread.

7. The device as claimed in any of the preceding claims, characterised in that a body-holder which extends over the whole width of the body and which presents a recumbent U-shaped element at its one end in the region of the open reflector side, one leg of the U-shaped element adjacent the reflector connecting at the end of the element remote from the bottom with a body-holder web arranged to close the open end surface of the reflectors, the U-shaped element being turned with its bottom remote from the shell or reflector body when the body-holder is mounted in position.

8. The device as claimed in claim 7, characterised in that the free leg of the U-shaped element carries at its free end a glass holder, which is preferably designed for the insertion of a glass plate by means of which the open side of the reflector can be shielded.

9. The device as claimed in either claim 7 or claim 8, characterised in that the U-shaped element on the body-holder arranged on the end surface of the reflector body is arranged to secure two transversely extending rails or bars at both end surfaces of a respective reflector body, and hence each U-shaped element is provided with a row of holes in both the legs, through which holes screws or other fastening can be inserted, the hole in the free leg of the U-shaped element having the double purpose of forming a lead-through for screws or the like and to permit ventilation air to pass therethrough when the device is in operation.

10. The device as claimed in claim 9, characterised in that the screws or like fasteners hold between their heads and the inside of the free leg of the U-shaped element a means for protecting the ends of the lamps, said means extending into the region beneath the reflector body for the purpose of conducting ventilation air thereto.

11. Infra-red radiation devices as claimed in claim 1 and as herein described.

12. The method of cooling and insulating an infra-red radiation device comprising a shell or reflector body having mounted thereon body-holders and holders for accomodating IR lamps, characterised in that air is passed through the reflector body and/or body holders through air gaps, holes or the like therein, past the ends of the lamps and outwards to cool the device and insulate it against the surroundings.

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